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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/711,414	09/17/2004	Yun-Ren Wang	NAUP0594USA	5413
27765	7590	12/14/2007	EXAMINER	
NORTH AMERICA INTELLECTUAL PROPERTY CORPORATION			MILLER, MICHAEL G	
P.O. BOX 506			ART UNIT	
MERRIFIELD, VA 22116			PAPER NUMBER	
			1792	
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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

winstonhsu.uspto@gmail.com  
Patent.admin.uspto.Rcv@naipo.com  
mis.ap.uspto@naipo.com.tw

<b>Office Action Summary</b>	Application No. 10/711,414	Applicant(s) WANG ET AL.	
	Examiner Michael G. Miller <i>MGM</i>	Art Unit 1792	

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 28 September 2007.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-4 and 6-9 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-4 and 6-9 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                       | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Response to Amendment***

- 1) Examiner notes that in the reply to the Office Action dated 29 Jun 2007, Applicant has incorporated the content of Claim 5 into Claim 1 and canceled Claim 5.

### ***Response to Arguments***

- 2) Applicant's arguments filed 28 Sep 2007 have been fully considered but they are not persuasive.
- 3) Applicant's argument states that in the '203 patent, the disposition of valves 28 and 29 prevents the evacuation of the piping between 29 and Chamber 1 once 29 is closed. This is moot, as Applicant does not call for complete evacuation of the supply line in the language of the claim; as such, since the piping from 22 to 29 is evacuated, and said piping is in the supply line, the supply line is evacuated insofar as the claim language requires.
- 4) Since claims 2-4 and 6-9 were rejected and not amended and since claim 1 as amended is not held as allowable, claims 2-4 and 6-9 remain as rejected.
- 5) Applicant claims that Claim 1 as amended solves a longstanding problem in the art. '203 acknowledges the problem of particle deposition from mingling system gases and uses purge and vacuum systems to remove gases from the system to prevent the deposition. Therefore, Applicant's claim merely seeks to use a known solution to solve a known problem.

***Claim Rejections - 35 USC § 103***

6) The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

- a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7) Claims 1-4 and 6-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Laxman et al (U.S. Patent 5,976,991, hereinafter '991) in view of Takahashi (U.S. Patent 5,517,943, hereinafter '943) and further in view of Kaizuka et al (U.S. Patent 6,436,203, hereinafter '203).

a) With regard to Claim 1, '991 teaches a method for depositing silicon nitride on a substrate, comprising:

- i) providing a chemical vapor deposition (CVD) system comprising a tubular furnace (Column 7 Lines 29-37, 58-64), at least one BTBAS (bis t-ButylaminoSilane) supply piping line (Column 7 Lines 58-64) connected to a base portion of said tubular furnace, an exhaust piping line (implicitly taught by the presence of the vacuum pump, Column 7 Lines 43-45) connected to an upper portion of said tubular furnace, a bypass line connecting said BTBAS supply piping line with said exhaust piping line (not explicitly taught), and a vacuum pump (Column 7 Lines 43-45) connected to said exhaust piping line, wherein said bypass line is initially interrupted (not explicitly taught);

- ii) placing a batch of wafers (Column 7 Lines 47-49) into a tube of said tubular furnace (Column 7 Lines 29-30);
- iii) flowing nitrogen-containing gas into said tube (Column 8 Lines 57-60);
- iv) flowing BTBAS into said tube through said BTBAS supply piping line (Column 8 Lines 57-60) and said vacuum pump (Column 7 Lines 42-45) maintaining pressure in said tube in a range of between about 0.1 Torr and 3 Torr (Column 3 Lines 16-17 discuss a range of 0.02 – 760 Torr; Column 8 Lines 57-60 disclose a pressure point of 0.5 Torr);
- v) performing a silicon nitride deposition process in said tube to deposit a BTBAS-based silicon nitride film on said wafers (Column 8 Lines 60-63; for silicon nitride deposition  $\text{NH}_3$  would be the preferred if not sole nitrogen-containing gas);
- vi) upon completion of said silicon nitride deposition process, interrupting said BTBAS supply piping line (see point 9 below) and opening said initially interrupted bypass line (not taught); and
- vii) removing said batch of wafers (see point 9 below).
- viii) '991 does not explicitly teach the vertical locations of the piping and exhaust lines, a bypass line, or that the bypass line starts out interrupted and is later opened.
- ix) It would have been obvious to a person having ordinary skill in the art at the time the invention was made to interrupt the BTBAS supply line at the end of

deposition, since terminating the flow of a reactant was a known way to terminate a reaction, and to remove the batch of wafers from the reactor at the end of processing, since it would have been desirable to use the reactor to coat multiple batches of wafers in its lifespan.

- b) '943 teaches an apparatus for chemical vapor deposition comprising:
- i) a tubular furnace (Item 3, Figure 1),
  - ii) at least one BTBAS (bis t-ButylaminoSilane) supply piping line (Items 6-8, Figure 1; taught as generic reaction gas supply lines) connected to a base portion (via Items 4a and 4b connected from Items 15a and 15b, Figure 1) of said tubular furnace,
  - iii) an exhaust piping line (Item 16A, Figure 1) connected to an upper portion of said tubular furnace (via Items 4a and 4b going to Items 16a and 16b, Figure 1),
  - iv) a bypass line connecting said BTBAS supply piping line with said exhaust piping line (not explicitly taught),
  - v) and a vacuum pump connected to said exhaust piping line (Item 19, Figure 1),
  - vi) wherein said bypass line is initially interrupted (not explicitly taught).
  - vii) '943 also teaches a 'flip-flop' gas flow pattern (Column 4 Lines 27-33, Column 5 Lines 7-16) which is advantageous for aiding the uniformity of the deposited coating.

- viii) '203 teaches a bypass mechanism (Column 4 Line 64 – Column 5 Line 65) comprising a valve (Item 26, Figure 2) for initiating and terminating the gas supply, a supply line (Item 21, Figure 2) for providing gas to the system, a switch valve (Item 28, Figure 2) for diverting flow between the chamber and the exhaust, a switch valve (Item 29, Figure 2) for controlling the flow of a purge gas, and an exhaust line (Item 36, Figure 2) to connect to the exhaust system (Item 9, Figure 2, not shown explicitly). '203 also teaches that this system is used to exhaust unwanted gas from the entire system (Column 7 Lines 22-29; there is no mention of valve 26 being closed so the system is evacuated all the way to the source). '203 also teaches that this bypass system is designed to prevent mingling of process gasses which may undergo unwanted side reactions (Column 8 Lines 48-63).
- ix) '203 also teaches that by opening said initially interrupted bypass line upon completion of said silicon nitride deposition process, said BTBAS remaining in said BTBAS supply piping line is evacuated through said bypass line without entering said tubular furnace, thereby eliminating particle problems (Column 8, Lines 48-63, taught with different gas but on identical principle).
- x) Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to have modified the apparatus as taught by modifying the apparatus of '943 to include a bypass mechanism connected to the exhaust system as taught in '203 because the bypass



mechanism prevents unwanted mixing of gases and prevents reaction of gases to form unwanted products.

- xi) Furthermore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to have performed the method of '991 using the apparatus of '943 as modified by the bypass mechanism of '203 because '991 teaches a method of depositing a silicon nitride film, '943 teaches an apparatus capable of depositing a silicon nitride film, and the apparatus of '943 advantageously improves the uniformity of the deposited film and therefore the quality of the final product.
- c) With specific regard to Claim 2, which includes all the limitations of Claim 1 above, '943 teaches:
  - i) Wherein after removing said batch of wafers, the process further comprises flowing cleaning gas into said tube (Column 5 Line 33 – Column 6 Line 38).
- d) With specific regard to Claim 3, which includes all the limitations of Claim 2 above, '943 teaches:
  - i) Wherein said cleaning gas comprises  $\text{ClF}_3$  (Column 8 Lines 1-7).
- e) With specific regard to Claim 4, which includes all the limitations of Claim 2 above, '943 teaches:
  - i) Wherein said cleaning gas comprises  $\text{NF}_3$  (Column 8 Lines 1-7).
- f) With specific regard to Claim 6, which includes all the limitations of Claim 1 above, '991 teaches:



- i) Wherein said nitrogen-containing gas comprises ammonia gas (Column 8 Line 57 – Column 9 Line 7).
- g) With specific regard to Claim 7, which includes all the limitations of Claim 1 above, '991 teaches:
  - i) Wherein silicon nitride deposition process is carried out at a temperature of between 450-600°C (Column 9 Lines 1-7 explicitly teaches 600°C).
- h) With specific regard to Claim 8, which includes all the limitations of Claim 1 above, '991 teaches:
  - i) Wherein said BTBAS is flowed into said tube at a flow rate of about 25-500 sccm (Column 8 Lines 60-63 explicitly teach 60 sccm of BTBAS).
- i) With specific regard to Claim 9, which includes all the limitations of Claim 1 above, '991 teaches:
  - i) wherein said nitrogen-containing gas is flowed into said tube at a flow rate of about 50-1000 sccm (Column 8 Lines 64-65 teach a flow of 200 sccm of nitrogen containing gases; as detailed in Figure 2, the composition of the mixture was allowed to vary).

***Conclusion***

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael G. Miller whose telephone number is (571) 270-1861. The examiner can normally be reached on M-F 7-4.


If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Cleveland can be reached on (571) 272-1418. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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MGM *MGM*

  
MICHAEL CLEVELAND  
SUPERVISORY PATENT EXAMINER